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Secondary Document

Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

SCIENCE APPLICATIONS INTERNATIONAL CORPORATION

contributed to the preparation of this document and should not be considered an eligible contractor for its review.

CERTIFICATION

Document Identification: ***Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky*** **(DOE/OR/07-2098&D2) Secondary Document**

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

U.S. Department of Energy (DOE)
Owner and Operator

William E. Murphie by Gregory G. Bagwell
William E. Murphie, Manager
Portsmouth/Paducah Project Office

11/25/03
Date Signed

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons directly responsible for gathering the information, the information submitted is to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Bechtel Jacobs Company LLC
Co-operator

Glenn E. VanSickle, Paducah Manager of Projects

11/25/03
Date Signed

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Site Investigation Work Plan for the C-746-S & T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky

Date Issued—November 2003

Prepared for the
U.S. DEPARTMENT OF ENERGY
Office of Environmental Management

by
Bechtel Jacobs Company LLC
managing the

Environmental Management Activities at the
Paducah Gaseous Diffusion Plant
Paducah, Kentucky 42001
for the
U.S. DEPARTMENT OF ENERGY
under contract DE-AC05-03OR22980

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Bruce E. Phillips, P.G.
Program Manager
Science Applications International Corporation

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CONTENTS

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CFR	*Code of Federal Regulations*
COC	chain-of-custody
DCE	dichloroethene
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPT	direct push technology
DSITMS	direct sampling ion trap mass spectrometer
DWRC	dual-wall reverse circulation
Eh	oxidation reduction potential
EPA	U.S. Environmental Protection Agency
ES&HP	Environmental, Safety, and Health Plan
GC	gas chromatograph
HSA	hollow stem auger
MIP	membrane interface probe
MW	monitoring well
NSDD	North-South Diversion Ditch
Paducah OREIS	Paducah Oak Ridge Environmental Information System
Paducah PEMS	Paducah Project Environmental Measurements System
PGDP	Paducah Gaseous Diffusion Plant
pH	negative logarithm of the hydrogen-ion concentration
PID	photoionization detector
PPE	personal protective equipment
QA	quality assurance
QAPP	Quality Assurance Project Plan
QC	quality control
RGA	Regional Gravel Aquifer
SI	Site Investigation
SMO	Sample Management Office
SWMU	solid waste management unit
TCE	trichloroethene
^{99}Tc	technetium-99
UCRS	Upper Continental Recharge System
VC	vinyl chloride
VOC	volatile organic compound
WMP	Waste Management Plan

EXECUTIVE SUMMARY

This Site Investigation (SI) Work Plan presents the basic strategies and procedures that will apply to fieldwork and groundwater sampling conducted as part of the C-746-S&T Landfill SI. This investigation will determine if upgradient sources of groundwater contamination are influencing the contamination observed in landfill groundwater monitoring wells (MWs).

The area of investigation is on the U.S. Department of Energy (DOE) reservation, north of the Paducah Gaseous Diffusion Plant (PGDP) and adjacent to the C-746-S&T Landfill area. Temporary borings will be used to collect groundwater samples from the top and base (approximately 50 ft to 100 ft below ground surface, respectively) of the Regional Gravel Aquifer (RGA) and every 10 ft within the RGA. Three transects of borings are planned. The west transect, oriented north-south along Old Waterline Road, contains four planned borings. The south transect, oriented east-west and south of Ogden Landing Road, has three planned borings. The east transect runs north to south along the power line corridor from the Shawnee Steam Plant near the Ohio River to PGDP and includes three planned borings. If required, up to seven contingency borings and three contingency groundwater wells may be installed as part of the investigation. After drilling and sampling is completed for each temporary boring, the boring will be abandoned in accordance with Commonwealth of Kentucky requirements. All boring locations will be surveyed at the end of the investigation.

Groundwater samples will be analyzed for volatile organic compounds, including trichloroethene and the radionuclide, technetium-99. Since the area of investigation may be impacted by contamination from either the Northwest Plume or the Northeast Plume, soils and groundwater recovered from the RGA will be handled as hazardous waste until waste characterization data indicate that the material is nonhazardous. After the analytical results from the investigation have been received, the data, along with data from existing groundwater MWs at the C-746 S&T and C-746-U Landfills, will be evaluated to determine if upgradient sources are responsible for the observed contamination. A report of the evaluation of data and the findings will be submitted.

1. PROJECT DESCRIPTION

This Site Investigation (SI) Work Plan presents the basic strategies and procedures that will apply to fieldwork and groundwater sampling conducted as part of the C-746-S&T Landfill SI. The following is the problem statement for this investigation.

> *Hazardous substances, specifically trichloroethene (TCE), have been detected above the maximum concentration limit in groundwater monitoring wells (MWs) in the area of the C-746-S&T Landfill. It is unknown if these substances are leaching from the landfill or if they are originating from upgradient sources.*

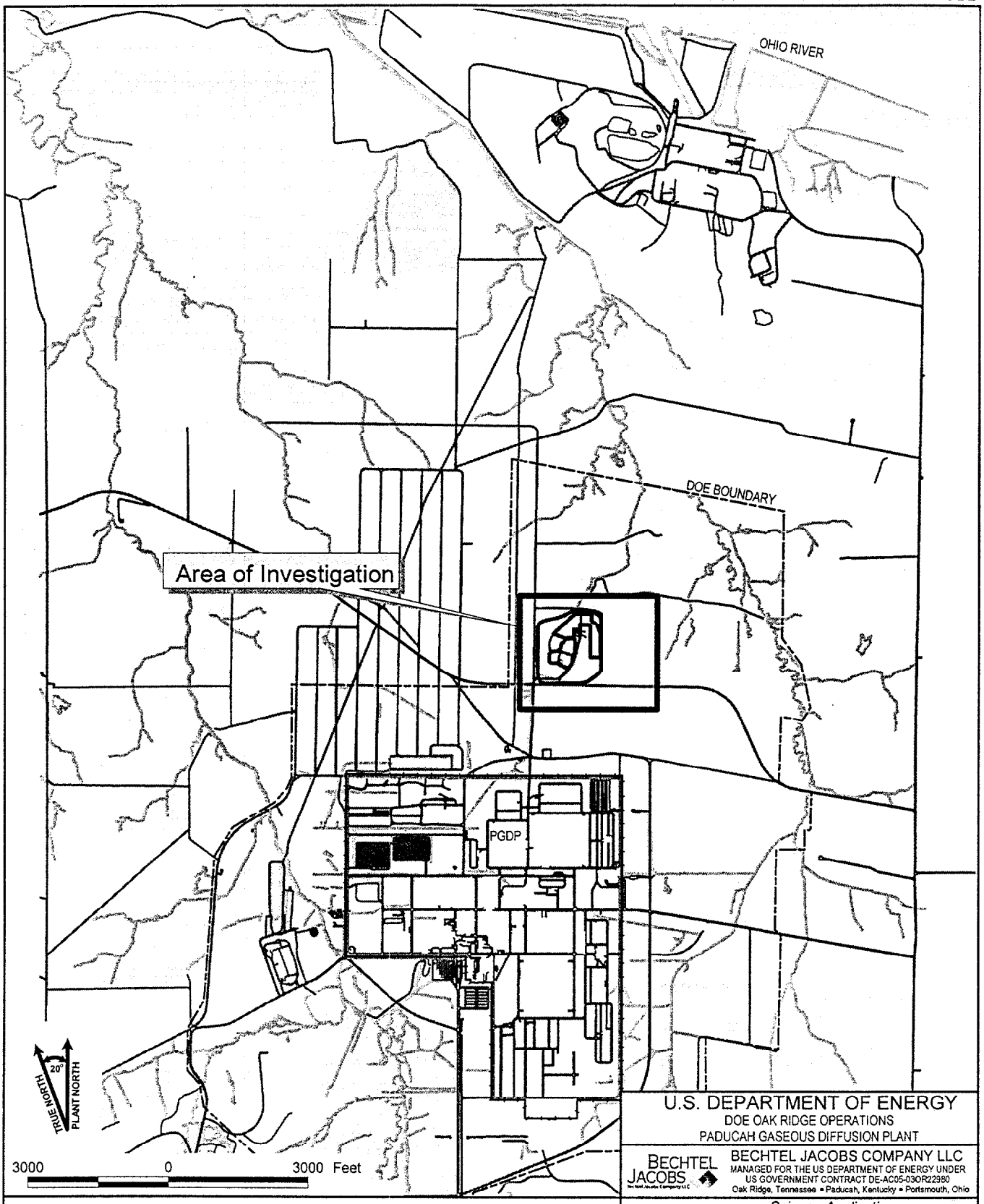
This SI will determine if upgradient sources of groundwater contamination are influencing the contamination observed in landfill groundwater MWs. The primary focus of the sampling strategy will be to collect sufficient groundwater data to determine the following:

> *Is all of the TCE and technetium-99 (^{99}Tc) detected in the groundwater MWs in the area of the C-746-S&T Landfill originating from upgradient sources?*

Possible resolutions to this question are that all of the TCE and ^{99}Tc is coming from upgradient sources, some of the TCE and ^{99}Tc is coming from upgradient sources, or none of the TCE and ^{99}Tc is coming from upgradient sources. To answer this question, a series of temporary borings will be installed south, west, and east of the landfill area to sample groundwater from the Regional Gravel Aquifer (RGA). Analytes of interest are the organic compounds TCE, 1,1-dichloroethene (DCE), *cis*-1,2-DCE, *trans*-1,2-DCE, and vinyl chloride (VC) (also known as TCE and its degradation products), as well as the radionuclide ^{99}Tc. Groundwater levels will be collected in existing MWs for the C-746-S&T Landfill, and all historical volatile organic compound (VOC) and ^{99}Tc data for the C-746-S&T Landfill will be reviewed. Due to its proximity to the C-746-S&T Landfill, analytical data from the C-746-U Landfill, located immediately north of the C-746-S&T Landfill, will be reviewed as well.

The C-746-S&T Landfill SI will be conducted within the U.S. Department of Energy (DOE)-unsecured area, north of the Paducah Gaseous Diffusion Plant (PGDP)-secured area (Fig. 1). The initial area of investigation will be south, west, and east of the landfill area. The field investigation area extends from approximately 1000 ft west of the west landfill fence to 1500 ft east of the east landfill fence and from 500 ft south of Ogden Landing Road to 1700 ft north of Ogden Landing Road. Vertically, the investigation will focus on the RGA, generally between 50 and 100 ft below ground surface (bgs). Investigation of this area will provide data on the amount of TCE and ^{99}Tc contamination, if any, that can be attributed to sources upgradient of the landfill area. The investigation consists of 10 planned borings and up to 7 contingency borings (Fig. 2). If the groundwater data from the initial borings indicate that some or all of the contamination is coming from within the landfill area, then additional borings will be required to assess the magnitude of the problem and to identify possible remedies to the problem, as required under the Commonwealth of Kentucky's Solid Waste Regulations.

If the answer to the principal study question is, yes, then no further action relative to the C-746-S&T Landfill area is required. However, further action, as part of the Groundwater Operable Unit, may be required in the future to address the groundwater contamination. If the answer is, no, then additional work will be required to determine how much TCE and ^{99}Tc is being contributed by sources in the landfill area.



U.S. DEPARTMENT OF ENERGY
DOE OAK RIDGE OPERATIONS
PADUCAH GASEOUS DIFFUSION PLANT

BECHTEL JACOBS COMPANY LLC
MANAGED FOR THE US DEPARTMENT OF ENERGY UNDER
US GOVERNMENT CONTRACT DE-AC05-03OR22980
Oak Ridge, Tennessee • Paducah, Kentucky • Portsmouth, Ohio

Science Applications
International Corporation
P.O. Box 2502
Oak Ridge, Tennessee 37831

Fig. 1. SI area location.

FIGURE No. c5ac90001sk653r1.apr
DATE 09-12-03

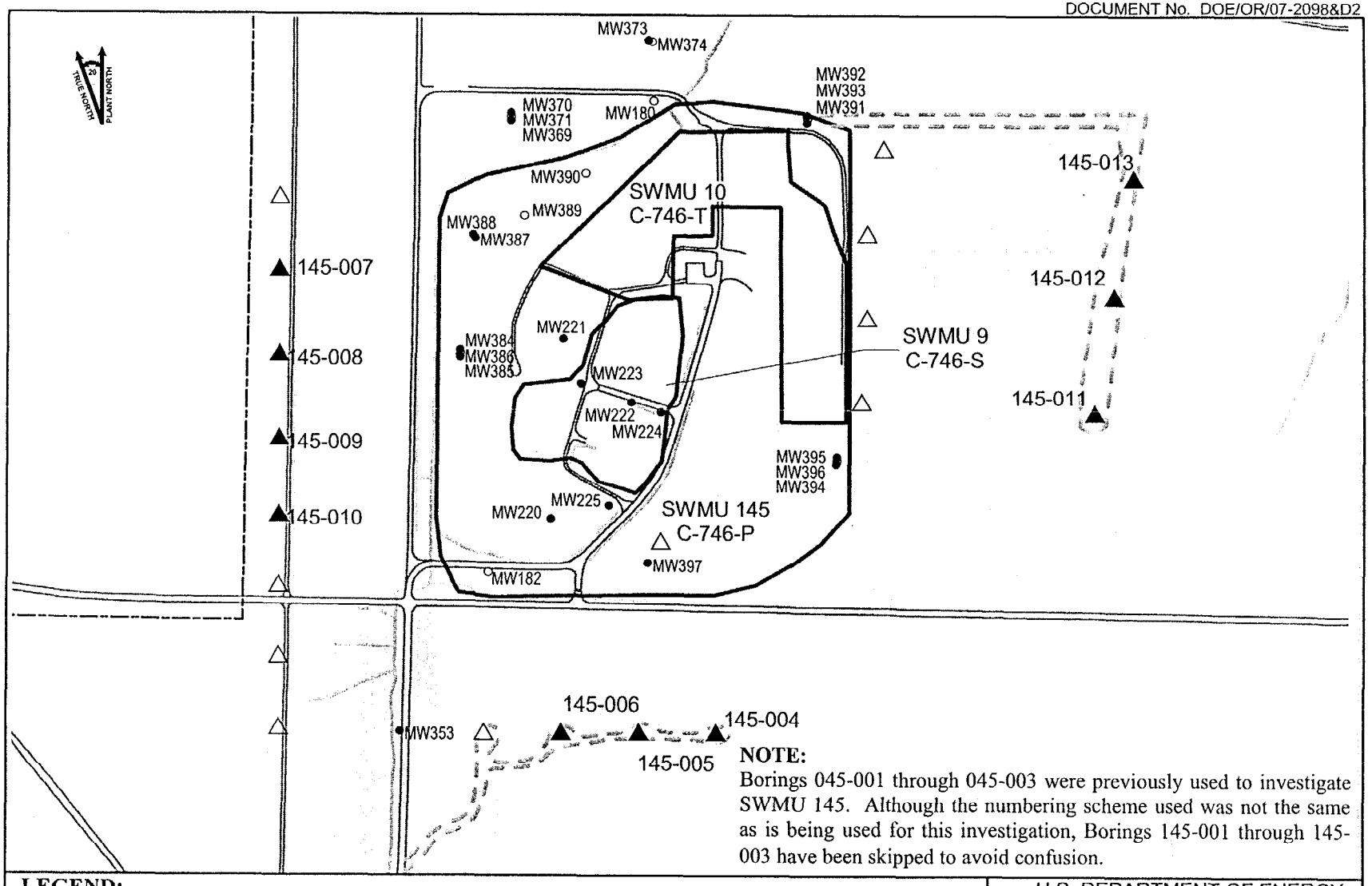


Fig. 2. Sample locations.

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DATE 09-12-03

2. SAMPLING AND ANALYSIS PLAN

The following sections discuss the sampling strategy and requirements.

2.1 SAMPLING MEDIA AND METHODS

This section identifies the different media to be sampled during the investigation and suggests methods for collecting the samples. Section 2.3 "Site-Specific Sampling Plans" discusses the sampling strategy in detail. Section 2.4 "Fieldwork and Sampling Methods and Procedures" describes drilling and abandonment methods and requirements as well as activities requiring formal procedures or work instructions. All investigation activities will be consistent with U.S. Environmental Protection Agency (EPA) procedures and protocols. At this time, the subcontractor(s) who will be responsible for conducting the activities described in this work plan have not been identified. Although this work plan has been prepared to provide limited flexibility, recommended drilling and sampling techniques, sampling locations, and procedural steps are identified.

2.1.1 Groundwater

The general sampling strategy for this SI focuses on collecting groundwater samples from multiple discrete depths within the RGA using temporary borings at several locations upgradient, (i.e., west, south, and east) of the landfill area. Water sampling will begin at the top of the RGA (approximately 50 ft bgs) and then continue every 10 ft until the base of the RGA is reached (approximately 100 ft bgs). This strategy results in 2 to 6 water samples from each boring, depending on the thickness of the RGA actually present in the boring. The borings will be drilled using methods that allow collection of discrete-depth water samples with minimum vertical cross-contamination. Three methods used previously at the PGDP that meet this requirement include dual-wall reverse circulation (DWRC), rotary sonic, and a combination of direct push technology (DPT) and hollow stem auger (HSA) drilling. Each of these drilling methods is described in more detail in Sect. 2.4.1. The drilling method selected will influence the water sampling method used.

Both DWRC and rotary sonic drilling allow collection of the water sample inside the drill pipe from the sediments at the face of the drill bit. As soon as each water-sample depth is reached and drilling stops, a water-level indicator will be placed in the hole, and the water level will be monitored each minute for up to 15 minutes. The purpose is to determine how fast the water level returns to equilibrium. The faster the water level stabilizes, the more permeable the interval being sampled and the greater the potential for the interval to be a preferred pathway for contaminant migration. After the groundwater level stabilizes (or 15 minutes), the sampling pump will be lowered into the boring and the sample collection process begun. The first step will be to purge the well. A bladder pump may be used to purge the boring and to collect water samples. Purging is required to eliminate the impact of the drilling fluid (air for DWRC and potable water for rotary sonic) on the interval being sampled. Since sampling will take place immediately after drilling ceases, there will be no stagnant water to remove from the boring and, therefore, no minimum purge volume. The water sample will be collected after sufficient water has been purged to allow geochemical parameters (i.e., pH, dissolved oxygen, conductivity, and temperature) to stabilize within the boring and to return to original aquifer conditions, as measured in existing MWs in the area. The geochemical parameters will be considered stabilized when the following criteria are met:

- at least three measurements taken three minutes apart have consistent readings for temperature, conductivity, and pH;

- temperature measurements agree within 1° C;
- conductivity measurements agree within 10%; and
- pH measurements agree within 0.5 units.

Values from area wells will be referenced to confirm that the stabilized values represent groundwater values and are not the result of groundwater being displaced by a large volume of potable water invading the sample interval during drilling. There is some natural variance across the area, so values from existing wells will be used as indicators of aquifer conditions, but not as specific reference values to determine stabilization within an individual boring. The pH value is the most useful indicator since the pH of RGA groundwater is around 6.5 units, while the pH of the PGDP potable water that may be used during drilling is 7.5 to 8 units.

When the geochemical parameters have stabilized, the flow rate of the sampling pump will be adjusted to 200 ml/minute or less for sampling. Groundwater samples will be collected for analysis for VOCs, including TCE and its degradation products, and ^{99}Tc. During each sampling event, the field parameters of depth to water, groundwater temperature, pH, specific conductance, oxidation reduction potential (Eh), and dissolved oxygen will be collected. After sampling is completed, the sample tubing and pump will be removed from the boring and decontaminated in accordance with approved procedures prior to its next use. Before drilling resumes, the groundwater level will be measured again to determine if any changes occurred during sampling. Groundwater samples for analysis of metals and radionuclides other than ^{99}Tc will not be collected from the temporary borings, because the results may not represent actual groundwater conditions due to the possible presence of suspended silts and clays in the water sample as a result of drilling. Aside from the fact that metals and radionuclides other than ^{99}Tc generally are not considered potential contaminants of concern within the dissolved phase contaminant plumes, water samples from temporary borings tend to bias high the metals and radionuclides concentrations, because the drilling process may mobilize, briefly, the silts and clays in the sediments and the metals and radionuclides that may be sorbed on to them.

The HSA/DPT combination permits the use of DPT-type water sampling probes within the RGA. The drive-point water sampler is pushed or driven below the bottom of the augers, permitting collection of a relatively undisturbed water sample with minimal cross-contamination. When the drive-point sampler has reached the target depth, the mechanism allowing collection of a groundwater sample will be activated. Groundwater will be pumped to the surface, typically with an inertial pump or mechanical bladder pump, although some air- or inert gas-driven systems are available and are preferred. The small inner diameter of the drive-point sampler limits the types of pumps that can be used with this system. A small amount of water, typically less than a gallon, will be purged to reduce the initial turbidity of the water sample. Since sampling will take place immediately after drilling ceases, there will be no stagnant water to remove from the boring and, therefore, no minimum purge volume. The water sample will be collected after sufficient water has been purged to allow geochemical parameters (i.e., pH, dissolved oxygen, conductivity, and temperature) to stabilize within the boring. The geochemical parameters will be considered stabilized when the following criteria are met:

- at least three measurements taken three minutes apart have consistent readings for temperature, conductivity, and pH;
- temperature measurements agree within 1° C;
- conductivity measurements agree within 10%; and
- pH measurements agree within 0.5 units.

After purging, groundwater samples will be collected for analysis for VOCs, including TCE and its degradation products, and ^{99}Tc. During each sampling event, the field parameters of depth to water, groundwater temperature, pH, specific conductance, Eh, and dissolved oxygen will be collected.

An additional alternative may be used to collect VOC samples. The membrane interface probe (MIP) uses a heating element and gas permeable membrane. The element heats the material surrounding the probe, causing the VOCs contained in the material to vaporize. The vapors enter the probe through a gas permeable membrane and are transported through tubing to the surface by an inert carrier gas. The sample then is analyzed in the field with equipment appropriate to the needs of the investigation. The system is based on DPT methods, but could be deployed within a DWRC or rotary sonic boring. Because this would be an unconventional use of the MIP, water samples using more traditional sampling methods as described above would be collected for comparison to the MIP results and to collect samples for field parameters and ^{99}Tc analysis.

2.1.2 Soils

Since this investigation is focused on RGA groundwater, no soil samples will be collected to determine nature and extent of contamination. Soils will be collected every 5 ft for lithologic description.

If DWRC drilling is used, soil cuttings will be collected every 5 ft from the outlet of the cyclone separator using a large strainer lined with filter paper to catch the fine-grained fraction of the sample. Rotary sonic drilling generates a continuous core contained in a sleeve that will be recovered and laid out for inspection and description.

If the HSA/DPT combination is used, two options are available. One option will be to use the DPT to collect soil samples every 5 ft to the top of the RGA using a core barrel and acetate sleeve to contain the sample. At the top of the RGA, the sampling method will change to HSA split-spoon sampling because the large gravel in the RGA prevents material from entering the DPT core barrel. Alternatively, HSA split spoons may be used from the surface to the base of the RGA.

2.1.3 Health and Safety

Sampling to protect the health and safety of the workers is an important part of the project. During drilling and sampling operations, a photoionization detector (PID) will be used to determine if VOCs are present in the workers' breathing zone at hazardous levels. Personal samplers also will be used to establish baseline values early in the project. Monitoring for radioactive constituents is not anticipated because the expected levels of ^{99}Tc are well below maximum contaminant levels and a radiation work permit will not be required. Additional details and requirements for health and safety sampling may be found in the project Environmental, Safety, and Health Plan (ES&HP) (BJC 2003a).

2.1.4 Investigation-Derived Waste

This project will generate soils, groundwater, decontamination water, personal protective equipment (PPE) and plastic, and miscellaneous noncontaminated trash. Some of the materials will be considered hazardous due to TCE contamination. Materials that will have to be sampled for waste characterization include soils and groundwater from the RGA, decontamination water, and PPE and plastic that come in contact with RGA soil or groundwater. These materials will be managed as hazardous waste as described in the project Waste Management Plan (WMP) (BJC 2003b). Section 1.6 of the plan covers waste characterization and sampling and analysis.

2.2 SAMPLE ANALYSIS

Sample analysis for this investigation consists of direct measurement of certain parameters in the field, analysis of groundwater samples for VOCs and ^{99}Tc, and characterization of project-generated waste materials. Specific analytical requirements, methods, and procedures are described in Sect. 2.8 of this document and in further detail in the Quality Assurance Project Plan (QAPP) for this SI Work Plan (BJC 2003c).

2.2.1 Field Parameters

Certain parameters, such as depth to water, pH, dissolved oxygen, specific conductance, Eh, and temperature will be measured in the field using appropriate field instruments such as meters and probes and in-line flow cells. Use of this equipment will be in accordance with manufacturers' operations manuals, work guides, or applicable approved procedures. These documents will be available on-site for reference by the project team members.

2.2.2 Groundwater Samples

In addition to field parameters, groundwater samples will be analyzed for VOCs and ^{99}Tc. Three options for sample analysis are available for VOCs. Two options are available for ^{99}Tc.

Decisions on the need for and placement of each boring will be based on the VOC data collected during the investigation. The sample analysis methods must be capable of rapid turnaround of analytical results to keep fieldwork moving forward and to prevent collecting unnecessary data. One option would be to send all samples to a fixed-base lab and require a maximum turnaround time of seven days, with shorter turnaround times preferable. Using this option will require careful planning of the drilling sequence to keep standby time at a minimum. The second option would be the use of a mobile field laboratory furnished with analytical equipment sensitive enough to meet the required minimum detection limits for TCE and its degradation products. If a mobile field lab is used, then 10% of the samples will be sent to a fixed-base lab for confirmation. If the MIP system is used to sample for VOCs, then use of a portable gas chromatograph (GC), photoacoustic analyzer, or direct sampling ion trap mass spectrometer (DSITMS) becomes a third option. As with the mobile field laboratory, the analytical equipment selected for use with the MIP must be sensitive enough to meet the required minimum detection limits for TCE and its degradation products. As noted in Sect. 2.1.1, if the MIP is used to collect groundwater samples, then conventional water samples also will be collected. These samples would be analyzed at either a fixed-base lab or mobile field lab, as described above.

For ^{99}Tc, the two options are a mobile field lab or a fixed-base lab. Since field decisions will not be dependent on ^{99}Tc activities in the groundwater, rapid turnaround times will not be required. The lab selection will be determined by the option that provides the best value. If a mobile field laboratory is selected, then 10% of the samples will be sent to a fixed-base lab for confirmation.

2.2.3 Waste Characterization

Wastes generated during this project will be characterized and disposed of within an acceptable timeframe. All samples will be sent to a fixed-base lab for analysis. Details of the sampling and analytical requirements for waste characterization are described in Sect. 1.6 of the WMP (BJC 2003b)

2.3 SITE-SPECIFIC SAMPLING PLANS

This section presents the sampling plan and logic for each of the borings shown in Fig. 2. Table 1 also provides a summary for each boring.

Table 1. Summary of groundwater sampling and analysis for the C-746-S&T SI

Boring Number[a]	Sample Depth[b]	Analytical Requirements
145-004	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
145-005	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
145-006	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
145-007	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
145-008	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
145-009	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
145-010	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
145-011	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
145-012	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
145-013	50, 60, 70, 80, 90 ft bgs	Depth to water, pH, temperature, dissolved oxygen, specific conductance, Eh, TCE and degradation products, ^{99}Tc
Total	50 sample intervals planned	

[a] Boring numbers 145-001, 145-002, and 145-003 were skipped to accommodate the first 3 borings that were collected near the landfill during the WAGs 3/8/28 and Data Gaps Investigation. The locations were mistakenly numbered 045-001, 045-002, and 045-003.

[b] Actual sample intervals dependent on observed field conditions.

bgs = below ground surface
Eh = oxidation reduction potential
TCE = trichloroethene
pH = negative logarithm hydrogen-ion concentration notation
^{99}Tc = technetium-99

2.3.1 General Sampling Strategy

The general sampling strategy for this SI focuses on collecting groundwater samples from multiple discrete depths within the RGA using temporary borings at several locations upgradient, (i.e., west, south, and east) of the landfill area. All borings will be drilled to the base of the RGA, approximately 100 ft bgs. Water sampling will begin at the top of the RGA (approximately 50 ft bgs) and then continue every 10 ft until the base of the RGA is reached. This strategy results in 2 to 6 water samples from each boring, depending on the thickness of the RGA actually present in the boring. Analytes of interest are the organic

compounds TCE, 1,1- DCE, *cis*-1,2-DCE, *trans*-1,2-DCE, and VC (also known as TCE and its degradation products), as well as the radionuclide ^{99}Tc.

The borings will be drilled using methods that allow collection of discrete depth water samples with minimum vertical cross-contamination. Three methods used previously at PGDP that meet this requirement include DWRC, rotary sonic, and a combination of DPT and HSA drilling. Within the south and west transects, the planned borings are approximately 250 ft apart. This spacing balances the need for detailed information about the groundwater with the cost required to drill, sample, and abandon each boring. Spacing within the east transect is irregular due to topography and vegetation. Ten potential locations for contingency borings have been identified; however, the installation of a maximum of only seven borings is anticipated. After each boring has reached the base of the RGA and the last water sample has been collected, the boring will be abandoned using approved methods. Surface locations will be surveyed after all borings are completed. The potential drilling methods and requirements for drilling and abandonment are described in Sect. 2.4 of this work plan.

Because the intent of this SI is to determine how much of the contamination in the RGA is due to sources upgradient of the landfill area versus the landfill area itself, groundwater from the Upper Continental Recharge System (UCRS) and soils are excluded. Groundwater movement through the UCRS to the RGA is nearly vertical with little lateral spread, making the UCRS a poor integrator unit for contamination. Because of this vertical migration, if the landfill is a source of contamination, it is unlikely that the contamination has migrated beyond the boundaries of the landfill in the shallow soils or UCRS groundwater. Since no drilling is planned within the boundaries of the landfill, soil and UCRS groundwater samples from locations outside the landfill are unlikely to contain VOCs or ^{99}Tc because of the nearly vertical movement of groundwater from the UCRS to the RGA.

In addition to the data collected from the temporary borings, results from the routine sampling of the existing MWs at the C-746-S&T and C-746-U Landfills will be incorporated into the evaluation of groundwater contamination in the landfill area. Finally, the combined data set will be used to determine the need for and placement of up to 3 contingency MWs.

2.3.2 South Transect

The south transect is designed to determine if groundwater contamination identified near the southeast corner of the C-616 Lagoons is migrating to the northeast and impacting MWs on the east side of the C-746 S&T Landfill. There are 3 temporary borings (145-004 – 145-006) planned in the south transect. This transect is east of MW353, approximately 400 ft south and parallel to Ogden Landing Road. Drilling for this transect may require the construction of a temporary road and drilling pads for access to the individual locations. The first boring (145-004) at the east end of the transect is just west of the high-voltage lines that run from the Shawnee Steam Plant, near the Ohio River, south to PGDP. The next boring, 145-005, is 250 ft west of 145-004; and the third boring, 145-006, continues the 250-ft spacing to the west. One contingency boring is tentatively located 250 ft west of 145-006, placing it midway between MW353 and boring 145-006. This contingency boring would be drilled if TCE values in 145-006 are 5 µg/L or greater. A second contingency boring tentatively is planned adjacent to MW397. MW397 is an isolated well that may be screened too deep to detect the TCE contamination that is seen in MW394 and MW395, located 700 ft to the northeast. The contingency boring would be drilled and sampled if any but the easternmost boring (145-004) in the transect encounters TCE concentrations above 5 µg/L.

2.3.3 West Transect

The temporary borings of the west transect are intended to determine if groundwater contamination associated with the Northwest Plume is impacting the MWs at the C-746-S&T Landfill. These borings will be located along the old water line road, approximately 400 ft west of the main north-south road connecting PGDP and the landfill area. Sample locations along this road are easily accessible, while the area between the two roads is heavily wooded and wet. This transect also is far enough away from the North-South Diversion Ditch (NSDD) (a possible source of ^{99}Tc contamination) and the landfill area that the data will reflect conditions unaffected by either the NSDD or the landfill. The transect consists of 4 planned borings (145-007 – 145-010), with an approximate spacing of 250 ft between borings. One contingency boring is tentatively located at the north end of the transect. This boring would be drilled if any sample in boring 145-007 detects TCE greater than 5 µg/L. Up to three contingency borings are tentatively located south of boring 145-010, extending the transect to immediately west of MW353. As with the contingency boring on the north end of the transect, each contingency boring on the south end would be drilled only if the boring immediately north encounters TCE concentrations greater than 5 µg/L. MW353, near the south end of the transect, is screened in the middle RGA. In October 2002, the water sample from the well had no detectable TCE, although it did have 86 pCi/L of ^{99}Tc. The investigation will incorporate data from MW353 in the interpretation of the results.

2.3.4 East Transect

Temporary borings 145-011, 145-012, and 145-013 are located in a transect approximately 1500 ft east of the east landfill fence and parallel to the power lines connecting the Shawnee Steam Plant to the north, with PGDP to the south. The intent of these borings is to determine if contamination seen on the east side of the landfill may be due to lateral expansion of the Northeast Plume. Drilling for this transect may require the construction of a temporary road and drilling pads for access to the individual locations. The topography and vegetation of the area dictates the spacing of these borings with the intent being to avoid low-lying and wooded areas as much as possible. A gap between two sets of power lines defines the location relative to the landfill. No contingency borings have been allocated to this transect due to the geography of the transect. Locations north of temporary boring 145-013 also would be north of the study area and would not provide information necessary to answer the study questions. The area south of temporary boring 145-011 and north of Ogden Landing Road consists of wetlands and wooded areas. The power lines exclude any locations immediately east or west of the planned transect.

2.3.5 Additional Contingency Borings

Four contingency borings are tentatively located along the east edge of the landfill area, between the well clusters at the southeast (MW394, MW395, and MW396) and northeast corners (MW391, MW392, and MW393) of the landfill area. Two of the three wells in each cluster have documented TCE concentrations above 10 µg/L in the RGA. These contingency borings will be drilled and sampled if TCE levels in the west, east, and south transects are below the levels seen in the two MW clusters.

2.3.6 Existing MWs

During the fieldwork portion of the project, water-level measurements will be collected weekly in area MWs. Potentiometric maps will be made using this data to determine any variation in groundwater flow directions that might impact sampling results from the temporary borings or the interpretation of the data.

Water level data will be collected weekly from the following wells.

MW220	MW222	MW224	MW353	MW373	MW391	MW397
MW221	MW223	MW225	MW370	MW385	MW395	

2.3.7 Contingency MWs

As data from the investigation becomes available, it will be added to the data from the existing landfill MWs. Interpretation of the combined data set will be used to determine the need for and location of up to three RGA MWs. The wells would be used to monitor contaminant pathways currently not monitored, either within the landfill area or in locations determined to be upgradient to the landfill. If the landfill area is determined to be the source of the groundwater contamination, then the MWs may be placed at locations determined to be downgradient of the landfill area.

After the boring has reached the base of the RGA and the last water sample has been collected, the boring will be abandoned using approved methods. Surface locations will be surveyed after all borings are completed.

2.4 FIELDWORK AND SAMPLING METHODS AND PROCEDURES

All fieldwork and sampling at PGDP will be conducted in accordance with approved medium-specific work instructions or procedures consistent with the *U.S. Environmental Protection Agency, Region IV, Standard Operating Procedures* revised last in 1996. The DOE and its Prime Contractor will approve any deviations from these work instructions and procedures. The Prime Contractor will document all changes on a Field Change Request form as detailed in the QAPP (BJC 2003c). Table 2 provides a list of investigation activities for the C-746-S&T SI that may require work instructions or procedures for guidance.

Table 2. Fieldwork and sampling activities that require procedures

Investigation Activity
Use of Field Logbooks
Lithologic Logging
Labeling, Packaging, and Shipping of Environmental Field Samples
Groundwater Sampling Procedures: Water Level Measurements
Monitoring Well Purging and Groundwater Sampling
Filter Pack and Screen Selection for Wells and Piezometers
Monitoring Well Installation
Monitoring Well Development
Temporary Boring and Monitoring Well Abandonment
Field Measurement Procedures: pH, Temperature, and Conductivity
Field Measurement Procedures: Dissolved Oxygen
Sampling of Containerized Wastes
Opening Containerized Waste
On-site Handling and Disposal of Waste Materials
Identification and Management of Waste Not From A Radioactive Material Management Area
Paducah Contractor Records Management Program
Quality Assured Data

Table 2. (continued)

Investigation Activity
Chain-of-Custody
Field Quality Control
Data Management Coordination
Equipment Decontamination
Off-site Decontamination Pad Operating Procedures
Cleaning and Decontaminating Sample Containers and Sampling Equipment
Environmental Radiological Screening
Pumping Liquid Wastes into Tankers
Archival of Environmental Data Within the Environmental Restoration Program
Data Entry
Data Validation

pH = negative logarithm hydrogen-ion concentration notation

2.4.1 Drilling Methods

The following sections briefly describe each of the three drilling methods suggested for use for the C-746-S&T SI. The MIP sampling system also is described. Additional details on groundwater sampling methods and requirements are included in Sect. 2.1.1.

Dual-Wall Reverse Circulation

DWRC is an air rotary drilling method using two concentric strings of drill pipe. In traditional air rotary drilling, the air travels through the center of the drill pipe, exits the bit, and returns to the surface by way of the annulus between the borehole wall and the drill pipe. The DWRC method is different from air rotary drilling in that the air used to lift the drill cuttings to the surface goes down the annulus between the two strings of drill pipe, exits at or near the drill bit, and returns to the surface through the center of the drill pipe. The drill bit is only slightly larger in diameter than the outer diameter of the outer drill string, resulting in almost no annular space between the drill pipe and the borehole wall. This minimal annular space and the reverse circulation of air that prevents contact of the air with the wall of the boring results in little opportunity for cross-contamination. The upward velocity of the air returning to the surface with the drill cuttings is on the order of 100 ft per second, which means that drill cuttings caught at the outlet of the air discharge cyclone are representative of the sediments at the face of the drill bit. To prevent oil contamination of the air stream, a filter normally is placed at the outlet side of the air compressor and is required if this drilling method is selected for the investigation.

When an interval for water sampling is identified, rotary drilling stops, but air circulation is maintained for a brief period to clear the hole of cuttings. After air circulation stops, water from the sample interval enters the drill pipe through the bit, allowing collection of the water sample in the protected environment of the drill pipe. The speed at which water enters the drill pipe and reaches a static water level is an indication of the hydraulic conductivity of the interval being sampled. The faster the water level stabilizes, the greater the hydraulic conductivity. Because some warm air may enter the interval being sampled, purging prior to sampling is recommended. Water temperature and dissolved oxygen, in particular, should be monitored during purging. When these return to *in situ* values, water samples may be collected. Sampling may be done using a bladder pump suitable for a 2-inch MW.

Waste generation consists of drill cuttings and water. Drill cutting volumes are near theoretical hole size, since the air circulation does not erode the borehole wall. The volume of water produced is dependent on the productive capacity of the sediments. Aquifers capable of producing large volumes of water can result in significant wastewater volumes.

DWRC drilling has been used for groundwater characterization at PGDP in the Phase IV Investigation; the Northeast Plume Interim Remedial Action; the WAG 6, WAG 27, WAG 28, and WAG 3 Remedial Investigations; and the "Data Gaps" investigation.

Rotary Sonic

Like DWRC, rotary sonic drilling uses two concentric strings of drill pipe with a drill bit designed to create minimal annular space between the drill pipe and borehole wall. Like DWRC, this configuration virtually eliminates vertical cross-contamination. Water sampling, using the same methodology, also takes place within the protected environment of the drill pipe where water from the interval being sampled enters the drill pipe through the drill bit. The primary differences are the method by which the drill string is advanced and the removal of the drill cuttings.

Rotary sonic drilling uses a combination of rotational movement and sonic resonance, which vibrates the drill string down through the sediments. The vibratory motion displaces the sediments laterally. The sediments near the outside of the drill string are pushed to the side of the borehole, while the sediments nearer the center of the drill string are captured as a core in a sleeve in the inner string of drill pipe. This drilling method results in a continuous core of sediments from the surface to the total depth of the hole as a natural by-product of the drilling process, rather than as an extra step requiring special equipment.

Rotary sonic drilling can install larger diameter MWs, such as the 4-inch wells recently installed at the C-746-S&T Landfill, without requiring the installation of protective casing from the surface to the top of the RGA. This is because the inner drill pipe can be withdrawn prior to well installation, leaving the outer drill pipe in place as a temporary protective casing. The MW then is built inside the outer drill pipe, as the outer drill pipe is withdrawn from the hole. A smaller hole diameter is required, and less well material is required compared to wells installed using hollow stem augers.

Waste generation consists of the soil core and water. Drill cutting volumes are near theoretical hole size since only the soils in the core sleeve are recovered at the surface. Potable water often is used while drilling above the water table to reduce friction and help displace drill cuttings and may return to the surface as wastewater. The volume of purge water produced is dependent on how much water is used during drilling and how quickly groundwater parameters return to *in situ* conditions after drilling stops.

Rotary sonic drilling has been used during the WAG 6 Remedial Investigation and the Site 3A Seismic Investigation.

Hollow Stem Auger/ Direct Push Combination

The HSA/DPT combination uses traditional hollow stem auger drilling combined with a direct push groundwater sampling assembly. The augers, fitted with a temporary plate at the face of the bit to prevent the entry of cuttings, are used to drill to approximately 5 ft above the interval to be sampled. A DPT groundwater sampling assembly is lowered inside the augers to the temporary plate. Then the DPT assembly is pushed or hammered through the temporary plate and 5 ft into the sediments below the auger bit to the sample depth. If the DPT assembly cannot be pushed or hammered through the sediments to a depth of 5 ft below the auger bit, the sample will be collected at the depth at which the assembly stopped. The actual sample depth will be recorded in the logbook and in sampling documentation, as appropriate.

When the drive point sampler has reached the target depth, the mechanism allowing collection of a groundwater sample will be activated. Groundwater will be pumped to the surface, typically with an inertial pump or mechanical bladder pump, although some air- or inert gas-driven systems are available. A small amount of water, typically less than a gallon, will be purged to reduce the initial turbidity of the water sample. After purging, groundwater samples will be collected for analysis for VOCs, including TCE and its degradation products, and ^{99}Tc. During each sampling event, the field parameters of depth to water, groundwater temperature, pH, specific conductance, Eh, and dissolved oxygen will be collected.

After the groundwater sample is recovered, the DPT assembly is withdrawn; the augers are recovered, fitted with a new temporary plate, run back into the hole, and the hole is deepened to within 5 ft of the next groundwater sample interval.

Membrane Interface Probe

The MIP is not a drilling method, but a real-time VOC profiling and sampling method. The MIP uses a heating element and gas permeable membrane. The element heats the material surrounding the probe, causing the VOCs contained in the material to vaporize. The vapors enter the probe through a gas permeable membrane and are transported through tubing to the surface by an inert carrier gas. The sample then is analyzed in the field with equipment appropriate to the needs of the investigation. If just the detection of VOCs is important, then a simple PID is all that is required. If a qualitative estimate of VOC concentration with depth is needed, then an electron capture detector system may be deployed. When quantitative analysis of individual VOC species is needed, the surface analytical equipment consists of a GC/Mass Spectrometer, DSITMS, or photoacoustic analyzer. The system is based on DPT methods, but could be deployed within a DWRC or rotary sonic boring. Because this would be an unconventional use of the MIP, water samples using more traditional sampling methods, as described in Sect. 2.1.1, would be collected for comparison to the MIP results and to collect samples for field parameters and ^{99}Tc analysis.

2.4.2 Boring Abandonment

After all the sampling in each boring is completed, the boring will be plugged and abandoned. Boring abandonment will be consistent with Commonwealth of Kentucky requirements and approved site procedures. The following bullets are a synopsis of the process.

- As the drill pipe or augers are withdrawn from the hole, high solids (at least 25%) bentonite grout will be added to the hole by tremie pipe, to within 18 inches of the ground surface.
- Once the rig is moved off the hole, the area around the boring will be roped off for safety.
- After 24 hours, the grout level will be checked and additional grout added, if necessary.
- When the grout level has stabilized, the remaining 18 inches of the hole will be filled with soil to ground level and a stake will be placed with the boring number so that the location of the boring may be surveyed.

2.4.3 Requirements

All borings will be installed and abandoned by a licensed and certified driller in the Commonwealth of Kentucky or a driller working under a licensed and certified driller in the Commonwealth of Kentucky. Upon completion of abandonment of each boring, the Kentucky Certified Driller will submit the Kentucky Well Abandonment Report to the Commonwealth of Kentucky in compliance with his/her certification.

2.5 DOCUMENTATION

Field documentation will be maintained throughout the SI in various types of documents and formats, including the field logbooks, sample labels, sample tags, chain-of-custody (COC) forms, and field data sheets. The following general guidelines for maintaining field documentation will be implemented. Additional information is contained in the Data Management Implementation Plan for this SI Work Plan (BJC 2003d).

- All entries will be written clearly and legibly using indelible ink.
- Corrections will be made by striking through the error with a single line that does not obliterate the original entry. Corrections will be dated and initialed.
- Dates and times will be recorded using the format "mm/dd/yy" for the date and the military (i.e., 24-hr) clock to record the time.
- Zeroes will be recorded with a slash (/) to distinguish them from letter Os.
- Blank lines are prohibited. Information should be recorded on each line or the line should be lined out, initialed, and dated.
- No documents will be altered, destroyed, or discarded even if they are illegible or contain inaccuracies that require correction.
- All information blocks on field data forms will be completed or a line will be drawn through the unused section, and the area will be dated and initialed.
- Unused logbook pages will be marked with a diagonal line drawn from corner to corner and a signature and date must be placed on the line.
- Security of all logbooks will be maintained by storing them in a secured (e.g., locked) area when not in use.
- Photocopies of all logbooks, field data sheets, and COC forms will be made weekly and sent to the project file.

2.5.1 Field Logbooks

Field team personnel will use bound field logbooks with sequentially numbered pages for the maintenance of field records and for documentation of any information pertinent to field activities. Field forms will be numbered sequentially or otherwise controlled. A designated field team member will record sampling activities and information from site exploration and observation in the field logbook. Field documentation will conform to approved procedures for use of field logbooks.

An integral component of Quality Assurance/Quality Control (QA/QC) for the field activities will be the maintenance of accurate and complete field records and the collection of appropriate field data forms. The primary purpose of the logbook is to document each day's field activities; the personnel on each sampling team; and any administrative occurrences, conditions, or activities that may have affected the fieldwork or data quality of any environmental samples for any given day. The level of detail of the information recorded in the field logbook should be such that an accurate reconstruction of the field events can be created from the logbook. The project name, logbook number, client, contract number, task number, document control number, activity or site name, and the start and completion dates will be listed on each logbook's front cover. Important phone numbers, radio call numbers, emergency contacts, and a return address should be recorded on the inside of the front cover.

2.5.2 Sample Log Sheets

A sample log sheet will contain sample-specific information for each field sample collected, including field QC samples. Generally, sample log sheets will be preprinted from the data management system with the following information:

- name of sampler;
- project name and number;
- sample identification number;
- sampling location, station code, and description;
- sample medium or media;
- sample collection date;
- sample collection device;
- sample visual description;
- collection procedure;
- sample type;
- analysis; and
- preservative.

In addition, all specific analytical requests will be preprinted from the data management system and will include the following for each analytical request:

- analysis/method,
- container type,
- number of containers,
- container volume,
- preservative (type/volume), and
- destination laboratory.

During sample collection, a field team member will record the remaining required information and will sign and date each sample log sheet. The following information will be recorded for each sample:

- whether or not the sample was collected;
- the date and time of collection;
- the name of the collector;
- collection methods and/or procedures;
- all required field measurements and measurement units;
- instrumentation documentation, including the date of last calibration;
- adherence to or deviation from the procedure and the SI Work Plan;
- weather conditions at the time of sample collection;
- activities in the area that could impact subsequent data evaluation;
- general field observations that could assist in subsequent data evaluation;
- lot number of the sample containers used during sample collection;

- sample documentation and transportation information, including unique COC form number, air bill number, and container lot number; and
- all relevant and associated field QC samples (for each sample).

If preprinted sample log sheets are not used, all information will be recorded manually. A member of the field sampling team (other than the recorder) will perform a QA review of each sample log sheet and document the review by signing and dating the log sheet. The Field Task Manager, as part of his/her review of the logbook, will initial all notations of deviations.

2.5.3 Field Data Sheets

Field data sheets will be maintained, as appropriate, for the following types of data:

- water level measurements,
- soil boring logs,
- monitoring well construction logs,
- sample log sheets,
- well development logs,
- well purging logs,
- groundwater sampling logs,
- COCs,
- instrument calibration logs, and
- temperature monitoring sheets.

Data to be recorded will include such information as the location, sampling depth, sampling station, and applicable sample analysis to be conducted. Field-generated data forms will be prepared, if necessary, based on the appropriate requirements. The same information may be included in the field logbook or, if not, the field logbook should reference the field data sheet. If preprinted field data sheets are not used, all information will be recorded manually in the field logbook.

2.5.4 Sample Identification, Numbering, and Labeling

In addition to field logbooks and field data sheets, the sampling team will use labels to track sample holding times, ensure sample traceability, and initiate the COC record for the environmental samples. A pressure-sensitive gummed label will be secured to each sample container at the time of collection, including duplicates and trip or field blanks, at or before the completion of collection of that sample. Sample labels will be waterproof or will be sealed to the sample container with clear acetate tape after all information has been written on the label. Generally, sample labels will be preprinted with information from the data management system and will contain the following information:

- station name,
- sample identification number,
- sample matrix,
- sample type (grab or composite),
- type or types of analysis required,
- sample preservation (if required), and
- destination laboratory.

A field sampling team member will complete the remaining information during sample collection including these items:

- date and time of collection, and
- initials of sampler.

The sample numbers will be recorded in the field logbook along with the time of collection and descriptive information previously discussed.

The sample identification protocol is outlined as follows:

sssnnnMA000

where

sss	identifies the solid waste management unit (SWMU) being investigated (in this case, 145);
nnn	identifies the sequential boring number (according to the same numbering scheme, sss-nnn identifies the location name);
M	identifies the media type (in this case, W, identifies the sample as groundwater);
A	identifies the sequential sample (usually "A" for a primary sample and "B" for a secondary sample); and
000	identifies the planned depth of the sample in ft bgs.

2.5.5 Sample COC

COC procedures will document sample possession from the time of collection, through all transfers of custody, to receipt at the laboratory and subsequent analysis. COC records will accompany each packaged lot of samples; the laboratory will not analyze samples that are not accompanied by a correctly prepared COC record. A sample will be considered under custody if it is (1) in the possession of the sampling team, (2) in view of the sampling team, or (3) transferred to a secured (i.e., locked) location.

COC records will follow the requirements as specified in a DOE Prime Contractor-approved procedure for keeping records. This form will be used to collect and track samples from collection until transfer to the laboratory. Copies of the signed COCs will be faxed or delivered to the DOE Prime Contractor Sample Management Office (SMO) within three days of sample delivery.

The Sampling Team Leader is responsible for reviewing and ensuring the accuracy and completeness of the COC form and for the custody of samples in the field until they have been properly transferred to the Sample Coordinator. He or she is responsible for sample custody until the samples are properly packaged, documented, and released to a courier or directly to the analytical laboratory. If samples are not immediately transported to the analytical laboratory, they will remain in the custody of the Sample Coordinator where they will be refrigerated and secured either by locking the refrigerator or by placing custody seals on the individual containers.

Each COC form will be identified by a unique number located in the upper-right corner, recorded on the sample log sheet at the time of sample collection. The laboratory COC will be the "official" custody record for the samples. Each COC form will contain the following information:

- the sample identification for each sample;
- collection data for each sample;
- number of containers of each sample;
- description of each sample (i.e., environmental matrix/field QC type);
- analyses required for each sample; and
- blocks to be signed as custody is transferred from one individual to another.

The airbill number will be recorded on the COC form if applicable. The laboratory COC form will be sealed in a resealable plastic bag and taped to the inside of the cooler lid if the samples are to be shipped off-site. A copy will be retained in the laboratory, and the original will be returned to the Sample Manager with the completed data packages.

At each point of transfer, the individuals relinquishing and receiving custody of the samples will sign in the appropriate blocks and record the date and time of transfer. When the laboratory sample custodian receives the samples, he or she will document receipt of the samples, record the time and date of receipt, and note the condition of the samples (e.g., cooler temperature, whether the seals are intact) in the comments section. The laboratory then will forward appropriate information to the Sample Manager. This information may include the following:

- a cover memo stating sample receipt date and any problems noted at the time of receipt; and
- a report showing the field sample identification number, the laboratory identification number, and the analyses scheduled by the laboratory for each sample.

2.5.6 Sample Shipment

An on-site laboratory will screen aliquots of investigative samples before shipment to an off-site laboratory. Results from the screening process will be recorded in Paducah's Project Environmental Measurements System (Paducah PEMS) and will be reviewed prior to preparation for sample shipment off-site. Sample containers will be placed in the shipping container and packed with ice and absorbent packing for liquids. The completed COC form will be placed inside the shipping container unless otherwise noted. The container then will be sealed. In general, sample containers will be packed according to the following procedures.

- Glass sample containers will be wrapped in plastic insulating material to prevent contact with other sample containers or the inner walls of the container.
- Logbook entries, sample tags and labels, and COC forms will be completed with sample data collection information and names of all persons handling the sample in the field before packaging.
- Samples, temperature blanks, and trip blanks will be placed in a thermally-insulated cooler along with ice that is packed in resealable plastic bags. After the cooler is filled, the appropriate COC form will be placed in the cooler in a resealable plastic bag attached to the inside of the cooler lid.
- Samples will be classified according to U.S. Department of Transportation (DOT) regulations pursuant to 49 *CFR* 173. All samples will be screened for radioactivity to ensure that DOT limits of 2.0 nCi/ml of liquid waste and 2.0 nCi/g for solid waste are not exceeded.

2.5.7 Field Planning Meeting

A field-planning meeting will occur before work begins at the site so that all involved personnel will be informed of the requirements of the fieldwork associated with the project. Additional planning meetings will be held whenever new personnel join the field team or if the scope of work changes significantly. Each meeting will have a written agenda and attendees must sign an attendance sheet, which will be maintained on-site and in the project files. The following topics will be discussed at these meetings:

- project- and site-specific health and safety,
- objectives and scope of the fieldwork,
- equipment and training requirements,

- procedures,
- required QC measures, and
- documents covering on-site fieldwork.

2.5.8 Readiness Checklist

Before implementation of the field program, all personnel will review the work control documents to identify all field activities and materials required to complete the activities, including:

- task deliverables,
- required approvals and permits,
- personnel availability,
- training,
- field equipment,
- sampling equipment,
- site facilities and equipment, and
- health and safety equipment.

Before fieldwork begins, appropriate DOE Prime Contractor personnel will concur that readiness has been achieved.

2.6 DECONTAMINATION PROCEDURES

Decontamination of all sampling equipment, drilling-related equipment, pumps, bladders, or other downhole sampling equipment, such as Teflon® tubing, will be in accordance with DOE Prime Contractor-approved procedures and EPA procedures and protocols.

PPE, clothing, and decontamination procedures for the implementation of the SI will be addressed in the ES&HP for this SI Work Plan (BJC 2003a).

2.7 WASTE MANAGEMENT PROCEDURES

PGDP waste management practices for the activities listed here will follow DOE Prime Contractor-approved procedures during the implementation of the SI:

- Off-Site Decontamination Pad Operation;
- Pumping Liquid Wastes Into Tankers;
- Sampling of Containerized Waste; and
- Opening Containerized Waste.

A detailed description of waste management procedures is presented in the WMP for this SI Work Plan (BJC 2003b).

2.8 PROCEDURES FOR SAMPLE ANALYSES

All laboratories performing analyses for the SI will be DOE-regulated or will be required to hold a current Nuclear Regulatory Commission or Agreement State License for handling radioactive materials. The DOE-Oak Ridge SMO must audit and accept all laboratories before mobilization for fieldwork.

When available and appropriate for the sample matrix, SW-846 methods will be used. When SW-846 methods are not available or are not appropriate, other nationally recognized methods such as DOE, EPA, and American Society for Testing and Materials methods will be used.

The following standardized procedure manuals are recommended references for radiological analysis:

- *Prescribed Procedures for Measurement of Radioactivity in Drinking Water*, EPA-600/4-80-032, 1980.
- *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods*, EPA SW-846, 1986.
- Eastern Environmental Radiation Facility, *Radiochemistry Procedures Manual*, EPA 520/ 5-84-006, 1984.
- *Environmental Measurements Laboratory Procedures Manual*, DOE HASL-300, 1982.

All groundwater samples will be analyzed for TCE and its degradation products and for ^{99}Tc. Analytical methods, method detection limits, sample container requirements, and sample preservation requirements for all environmental and waste characterization sampling required during this SI are addressed in the QAPP (BJC 2003c).

2.9 SAMPLE LOCATION SURVEYING

Surveying of sampling locations will be conducted upon completion of SI field activities. Where possible, permanent markers consisting of flagging or of wooden or metal stakes will be used to mark all boring locations. Brass markers will be incorporated as part of pad installation for all MWs; however, a thorough description of each location will be made during field sampling activities and will be documented using field maps. This documentation will be used for the survey effort if permanent sampling location markers are disturbed or if permanent markers cannot be placed at the time of sampling. A member of the field sampling crew will accompany the survey crew to provide information regarding the location of sampling points. Each sample point will be surveyed for its horizontal and vertical location using the PGDP coordinate system for horizontal control. Additionally, State Plane Coordinates will be provided using the U.S. Coast and Geodetic Survey North American Datum of 1983. The datum for vertical control will be the U.S. Coast and Geodetic Survey North American Vertical Datum of 1988. Accuracy for this work will be that of a Class 1 First Order survey. Work will be performed by or under responsible charge of a Professional Land Surveyor Registered in the Commonwealth of Kentucky. All coordinates will be entered into Paducah PEMS and will be transferred with the station's ready-to-load file to Paducah's Oak Ridge Environmental Information System (Paducah OREIS).

3. REFERENCES

BJC (Bechtel Jacobs Company LLC) 2003a. *Environmental, Safety, and Health Plan for the C-746-S&T Landfill Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* BJC/PAD-585, Bechtel Jacobs Company LLC, September.

BJC 2003b. *Waste Management Plan for the C-746-S&T Landfill Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* BJC/PAD-584, Bechtel Jacobs Company LLC, September.

BJC 2003c. *Quality Assurance Project Plan for the C-746-S&T Landfill Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* BJC/PAD-582, Bechtel Jacobs Company LLC, September.

BJC 2003d. *Data Management Implementation Plan for the C-746-S&T Landfill Site Investigation at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky,* BJC/PAD-583, Bechtel Jacobs Company LLC, September.

Comment Response Summary

for the

Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Prepared for
U.S. Department of Energy
Office of Environmental Management

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COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
KDEP 1	General	Kentucky Department for Environmental Protection (KDEP): "At this time, the Division cannot approve the use of the Membrane Interface Probe technology as the primary means of gathering VOC concentration data for this investigation. To date, information reviewed by Division staff suggests that the MIP is a screening technology perhaps suitable for use in those instances when a determination as to the presence or absence of VOC contamination is required. The instrument also appears to be capable of producing quantitative estimates of VOC contamination in soils and groundwater. No evidence has been presented to the Division supporting the MIP's ability to detect relatively low levels of VOCs in groundwater as is possible using the standard SW-846 fixed-based laboratory method. DOE must present a stronger case in support of this technology if it desires to use the MIP as a stand-alone means of gathering VOC data during future investigations. In particular, DOE should indicate the precision and accuracy that can be obtained using this technology and how these parameters are affected when attempting to measure relatively low levels of TCE (e.g., less than 30 ppb)."	Agree. The primary method of collecting VOC and radionuclide data will be groundwater sampling and laboratory analyses. The MIP will be used as a secondary means of collecting real-time VOC data in the field.

32

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
KDEP 2	General	KDEP: "The *Site Investigation Work Plan for the C-746-S&T Landfill* represents the practice of geology in the Commonwealth of Kentucky. Therefore it must be certified by a professional geologist registered in Kentucky, as required by 401 KAR 48:300, Section 1, of the Solid Waste Regulations. In addition, the work plan must be submitted and signed by the site manager in accordance with 401 KAR 47:160, Section 6(2). The submittal must include the certification statement required by 401 KAR 47:160, Section 6(4)."	Agree. The appropriate certifications are included in the D2 version of the document.
KDEP 3	Section 1; Page 1; 4th paragraph	KDEP: "The statement is made here that if a connection cannot be made between the major dissolved phase plumes and the contamination detected in landfill monitoring wells then additional work 'may be required' to assess the degree to which the landfills are contributing to aquifer contamination. Modify this sentence to indicate that further work will be required to assess the magnitude of the problem and to assess possible remedies to the problem as required under Kentucky's Solid Waste Regulations."	Agree. The last sentence of the paragraph has been revised to read: "If the groundwater data from the initial borings indicate that some or all of the contamination is coming from within the landfill area, then additional borings will be required to assess the magnitude of the problem and to identify possible remedies to the problem as required under the Commonwealth of Kentucky's Solid Waste Regulations."

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
KDEP 4	Section 1; Page 1; Last paragraph	KDEP: "The first sentence explains that if all of the TCE and technetium-99 detected by the C-746-S&T Landfill groundwater monitoring well network is originating from upgradient sources, then no further action will be required. While no further action may be required for the S&T Landfills, it is possible that there could be further action required in the future to prevent/remediate the contamination from upgradient sources. This sentence should be reworded to reflect this point."	Agree. The paragraph has been rewritten as follows: "If the answer to the principal study question is, yes, then no further action relative to the C-746-S&T landfill area is required. However, further action, as part of the Groundwater Operable Unit, may be required in the future to address the groundwater contamination. If the answer is, no, then additional work will be required to determine how much TCE and ^{99}Tc is being contributed by sources in the landfill area."
KDEP 5	Section 2.1.1; Page 4; 3rd paragraph	KDEP: "The work plan presents three different drilling options: Dual Wall Reverse Circulation (DWRC), Rotary Sonic, and a Hollow Stem Auger/Direct Push Type (HAS/DPT) combination. There is no reason given for DOE's reluctance to commit to a particular drilling method. Therefore, the work plan must be modified so as to specifically indicate the drilling method that will be utilized. If the DWRC method is selected, an air filter must be installed on the compressor in order to protect against introducing contaminants down the borehole. This must be stated in the work plan."	Disagree. The Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content. Agree. Text has been added in Section 2.4.1 requiring that air for the DWRC method be filtered to prevent oil contamination.

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
KDEP 6	Section 2.1.1; Page 4; 4th paragraph	KDEP: "This paragraph describes the general procedure that will be used to collect groundwater samples from investigation borings drilled using either the DWRC or rotary sonic methods. The paragraph should more clearly explain how DOE's contractors intend to purge the boreholes prior to collecting groundwater samples. The paragraph mentions taking water level readings as soon as the sample depth is reached with the intent being to estimate hydraulic conductivity. Given that estimating hydraulic conductivity is the objective, it would seem prudent to first purge the boring to the degree possible prior to taking water level measurements. DOE should describe here in greater detail how it intends to purge the boreholes of groundwater and how it will determine when water quality parameters have stabilized. The method of comparing water quality data to that measured in nearby monitoring wells in order to determine when stabilization has occurred is inconsistent with the site's groundwater monitoring procedures and may be difficult to implement given that parameters such as pH and conductivity can vary sometimes significantly from well to well. Therefore, stabilization should be determined by comparing multiple readings of the various parameters from a single well as is typically done. DOE is reminded that VOC samples must be collected using a flow rate of no greater than 200 ml/min. therefore a sample pump should be selected and identified in the work plan that will permit sample collection at this low flow rate."	Partially agree. Text has been added to more clearly explain how groundwater purging will be done prior to sampling and the criteria to be met before sampling is begun. Purging the hole prior to taking water levels defeats the purpose of monitoring the rate of recovery. The estimate of hydraulic conductivity will be a qualitative estimate rather than quantitative.

35

COMMENT RESPONSE SUMMARY for the *Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/OR/07-2098&D1 issued September 2003)			
Comment Number	**Sect. Page/Para.**	**Reviewer and Comment**	**Response**
KDEP 7	Section 2.1.1; Page 5; 1st paragraph	KDEP: "One of the drilling methods presented in the work plan is the HAS/DPT combination method. The description of this technique fails to specify the depth to which the geoprobe sampling screen would be driven prior to collecting a groundwater sample. This information must be presented in the work plan if DOE chooses to commit to using the HSA/DPT drilling method. In addition, the criteria that would be used to determine when a sufficient volume of water has been purged must be specified."	Agree. Additional information has been included in Section 2.4.1 describing the requirements and criteria associated with this drilling and sampling method. Additional information will be added to this section addressing the actual water sampling process.
KDEP 8	Section 2.1.1; Page 5; 1st paragraph	KDEP: "Two possibilities are suggested as to how water will be drawn to the surface for sampling, an inertial pump or mechanical bladder pump. DOE must be specific as to the type of equipment that will be used in the field. The pump or other device selected must be capable of low flow rates (i.e., 100 ml/min) and should allow for minimal agitation of the water being sampled. Acceptable choices would include an air driven bladder pump of Grundfos pump."	Disagree. The Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content. Although specific procedures have not been identified, procedural information that is consistent with EPA-approved procedures has been added to the work plan.

96

COMMENT RESPONSE SUMMARY for the *Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/OR/07-2098&D1 issued September 2003)			
Comment Number	**Sect. Page/Para.**	**Reviewer and Comment**	**Response**
KDEP 9	Section 2.2.2; Page 6; 5th & 6th paragraphs	KDEP: "DOE describes three options for sample analysis of volatile organics and two options for Tc-99 testing. DOE must commit to a specific testing method for each of the analytes. These methods must be specified in the revision to this work plan. The MIP cannot be used as the primary means of testing for VOCs."	Disagree. The Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content. Note, however, that DOE has agreed to remove the MIP as a primary means of testing for VOCs in this investigation.
KDEP 10	Section 2.2.3; Page 7; 1st paragraph	KDEP: "The first sentence states 'Analysis of waste characterization samples will not be a time-critical activity.' DOE needs to define the time frame for waste characterization and disposal."	Agree. The referenced sentence has been deleted, and the work plan has been revised to state that the generated wastes will be characterized and disposed of within an acceptable timeframe.

37

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
KDEP 11	Section 2.3.2; Page 8; 5th paragraph	KDEP: "According to the text, the contingency boring located between MW353 and boring 145-006 would be drilled only if TCE is detected at 145-006 at a level greater than or equal to 10 ug/L. This threshold is inconsistent with the 5-ug/L threshold referred to elsewhere in the work plan. In the past, DOE has inferred the presence of a finger of TCE contamination extending northward from the C-616 Lagoons. It is possible that TCE detected at a level lower than 10 ug/L in boring 145-006 could represent the eastern edge of this finger of contamination. If this were the case, then failure to drill and sample the contingency boring would result in a failure to identify the finger. Therefore, the threshold level should be reduced to 5 ug/L."	Partially agree. MW353 has already defined a <5 µg/L point for TCE in the middle RGA, southwest of the landfill area. Similarly, on the south side of the landfill area, MW397 defines a <5 µg/L point for TCE in the lower RGA, and MW220 and MW225 do the same for the upper RGA. Because the landfill area acts as a potentiometric mound during part of the year, the most likely paths for a possible finger coming from the C-616 area are either due northwest of the landfill area or northeast, wrapping around the southeast corner of the landfill area. MW353 and boring 145-006 are only 500 feet apart, so a finger of contamination with MW353 and 145-006 forming the western and eastern boundaries, respectively, is unlikely. However, for completeness and consistency, the threshold level has been revised to 5 µg/L.
KDEP 12	Section 2.3.2; Page 9; 1st paragraph	KDEP: "The first full sentence of this paragraph refers to 'the westernmost boring.' This should read, 'easternmost boring.' "	Agree. Sentence has been corrected.
KDEP 13	Section 2.3.4; Page 9; 3rd paragraph	KDEP: "The second sentence of this paragraph refers to contamination present at the 'west side' of the landfill. This should be changed to 'east side.' "	Agree. Sentence has been corrected.

COMMENT RESPONSE SUMMARY for the *Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/OR/07-2098&D1 issued September 2003)			
Comment Number	**Sect. Page/Para.**	**Reviewer and Comment**	**Response**
KDEP 14	Section 2.4.1; "Drilling Methods"; Pages 11-12	KDEP: "This section should provide details associated with the single drilling method to be selected for use during this investigation. It should also specify, in detail, how groundwater samples would be collected from the borehole. Sampling details should include, but would not necessarily be limited to, required purge volumes, analyte-specific sampling flow rates, and field parameter stabilization criteria."	Partially agree. Groundwater sampling methods are now described in detail in Section 2.1.1. Also, please see response to KDEP Comment #5.
KDEP 15	Section 2.4.2; Page 13; 4th paragraph; Bullets 1-3	KDEP: "The well abandonment procedure described here involves filling the boring to be abandoned with sand from the bottom of the hole to the top of the RGA. This is completely unacceptable and is inconsistent with EPA's Standard Operating Procedures that this work plan commits to following. All borings must be tremie grouted to the surface using at least 30% solids bentonite grout or cement-bentonite (90/10 ratio) grout."	Agree. The workplan has been revised to indicate that the wells will be plugged and abandoned in accordance with EPA's SOPs.
KDEP 16	Section 2.5.5; Page 17; 2nd paragraph	KDEP: "The first sentence contains a typographical error. The sentence should read: 'COC records will follow the requirements as specified in a DOE Prime Contractor-approved procedure for keeping records.' "	Agree. Sentence has been corrected.

COMMENT RESPONSE SUMMARY for the *Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/OR/07-2098&D1 issued September 2003)			
Comment Number	**Sect. Page/Para.**	**Reviewer and Comment**	**Response**
KDEP 17	Waste Mgmt. Plan; Section 1.5.1; Page 9; 4th paragraph	KDEP: "This paragraph refers to field screening of concrete rubble. Concrete rubble should not be encountered during this investigation. Delete the words 'concrete rubble' from the paragraph."	Agree. Concrete reference has been removed from the Waste Management Plan.
KDEP 18	Waste Mgmt. Plan; Section 1.6.2.2; Page 14; Table 4	KDEP: "Table 4 lists detection limits for waste characterization of wastewater. If it is assumed that this table applies to all wastewater generated during this investigation, then the detection limit for TCE listed in the table is inadequate. The detection limit for TCE must be the lowest achievable, not the KPDES limit of 0.0807 mg/L. Modify the table accordingly."	Partially agree. The value in the table represents the maximum allowable detection limit. A note has been added to Table 4 to indicate "the lowest achievable detection limit will be applied."
KDEP 19	Waste Mgmt. Plan; Appendix A; Page A-2; Waste Generation Plan	KDEP: "Material to be tested for VOCs must be placed into sample jars prior to compositing the sample matrix. Modify the two(2) boxes under column 5 to indicate that material to be analyzed for VOCs will not be composited."	Agree. The boxes have been modified to indicate that the material to be analyzed for VOCs will not be composited.
KDEP 20	Waste Mgmt. Plan; Appendix A; Page A-3; Waste Generation Plan	KDEP: "The last box in Column 9 of the table must be modified to read 'Water containing high-suspended solids will be filtered prior to placement in the 20,000-gal frac tank for treatment.' As it currently reads, there is no indication that RGA wastewater will be treated to remove VOCs. DOE is reminded that all frac tanks containing hazardous waste must be kept closed except during those times when they are being filled."	Agree. The table will be modified to read, "Water containing high-suspended solids will be filtered prior to placement in the 20,000-gal frac tank for treatment.

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
KDEP 21	Quality Assurance Project Plan; Section 9.2; Page 14; Table 11	KDEP: "The detection limits for VOCs have been omitted from the table. Please add these limits to the table."	Agree. Detection limits consistent with those presented in Table 8 have been added to Table 11.
KDEP 22	Data Mgmt. Implementation Plan	KDEP: "No Comments."	No reply required.
KDEP 23	ES&H Plan	KDEP: "No Comments."	No reply required.

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
EPA 1	General	U.S. Environmental Protection Agency (EPA): "The purpose of this document is stated as follows: '...presents the basic strategies and procedures that will apply to fieldwork and groundwater sampling conducted as part of the C-746-S&T Landfill SI.' Within the Sampling and Analysis Plan portion of the document, several different drilling and sample acquisition techniques are presented. However, no explanation is provided as to why multiple techniques are discussed, or why the specific techniques to be used for drilling and sampling are not identified within this work plan. Based on the failure of the Department of Energy to present a clear and specific description of the drilling and sampling techniques to be used for the C-746-S&T Landfill Site Investigation, EPA does not understand how this document constitutes a site investigation work plan. Section 2 of this document requires revision to either (a) provide a complete description of the actual drilling and sampling techniques to be used for the investigation, or (b) provide an explanation as to why specific drilling and sampling techniques are not addressed in the work plan."	As previously indicated, the Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content. Agree. The following text has been added to Section 2 of the work plan: "At this time, the subcontractor(s) who will be responsible for conducting the activities described in this work plan have not been identified. Although, this work plan has been prepared to provide limited flexibility, recommended drilling and sampling techniques, sampling locations, and procedural steps are identified."
EPA 2	General	EPA: "EPA Region 4 has standardized field procedures in which to conduct remedial investigations. It is expected that DOE will follow these field protocols and procedures and not deviate from the methodology unless prior approval (in writing) is provided by EPA. The EPA Region 4 Environmental Investigations Standard Operating Procedures and Quality Assurance Manual can be found on the internet at: http://www.epa.gov/Region4/sesd/eisopqam/eisopqam.pdf"	Agree. The investigation activities will be conducted in accordance with EPA procedures. Approval of any variations to approved EPA protocols and procedures will be obtained prior to use in the field. Regarding use of the proposed MIP, it is believed to be cost-effective and accurate, and EPA has always encouraged innovation in field and sampling methods in the quest for better quality data and lower costs.

COMMENT RESPONSE SUMMARY for the *Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky* (DOE/OR/07-2098&D1 issued September 2003)			
Comment Number	**Sect. Page/Para.**	**Reviewer and Comment**	**Response**
EPA 3	Section 1; Page 1; 4th paragraph; Last sentence	EPA: "It is noted that additional borings may be required on the south or east sides of the landfill area in the event that groundwater data from initial borings indicate that some or all of the contamination is coming from within the landfill area. Revision of this paragraph is required to explain why additional borings would not also be required on the west side of the landfill area."	Agree. Sentence has been revised to remove references to east and south sides of landfill to not restrict scope of any additional required work. Please see response to KDEP Comment #3
EPA 4	Section 2.1.1; Page 4; 2nd paragraph; 6th sentence	EPA: "This sentence states that sampling will commence after sufficient water has been purged to allow geochemical parameters (i.e., pH, dissolved oxygen, and temperature) to return to original aquifer conditions as measured in existing monitoring wells in the area. Additional text or a table should be added to this section of the document that describes the variance tolerance between geochemical parameters measured in existing monitoring wells and those measured during borehole purging to achieve 'original aquifer conditions.'"	Agree. Additional text has been added describing the purging requirements in more detail.

3h

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
EPA 5	Section 2.3.1; Page 8; 3rd paragraph; Last sentence	EPA: "This sentence states that since no drilling is planned within the boundaries of the landfill, soil and UCRS groundwater samples from locations outside the landfill are unlikely to contain VOCs or ^{99}Tc. This sentence should be revised to indicate why (i.e., that the unlikely presence of VOCs or ^{99}Tc outside of the landfill is believed to be due to the nearly vertical movement of groundwater from the UCRS to the RGA). Is there any contingency for angular borings beneath the landfill?"	Agree. This concept, which is stated elsewhere in the text, has been added to Section 2.3.1 as suggested. There are no plans for angled borings beneath the landfill.
EPA 6	Section 2.3.4; Page 9	EPA: "The description provided for the East Transect in this section of the document does not include a provision for contingency borings. This section should be revised to provide an explanation as to why contingency borings are designed for the South and West Transects, but not for the East Transect."	Agree. The requested clarification has been added.

hh

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
EPA 7	Section 2.4; Page 10; Table 2	EPA: "This table is titled 'Fieldwork and sampling procedures'; however, it only lists investigation activities that may require work instructions or procedures for guidance. Based on the fact that this document is intended to be the work plan for the site investigation, it is reasonable to assume that the Department of Energy would be able to identify the specific fieldwork and sampling procedures to be implemented. Table 2 should be revised to include the specific work instructions or procedures associated with the listed investigation activities, including all aspects of groundwater sampling."	Disagree. The Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content.
EPA 8	Section 2.6; Page 19; 1st paragraph	EPA: "This paragraph notes that decontamination of sampling equipment will be in accordance with DOE Prime Contractor-approved procedures. This paragraph should be revised to include identification of the specific procedures to be used for equipment decontamination, and a brief summary of the planned decontamination procedures. At minimum, the procedures and protocols should be consistent with the EPA Region 4 field procedures manual (see General Comment 2)."	Partially Disagree. The Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content. Text has been added to the work plan to indicate that investigation activities will be conducted in accordance with EPA procedures.

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
EPA 9	Quality Assurance Project Plan; Section 3; Page 3; 3rd paragraph	EPA: "This paragraph notes that training will be conducted in accordance with DOE Prime Contractor-approved procedures. This paragraph should be revised to include identification of the specific procedures to be used for training, and a brief summary of the planned personnel training to be conducted."	Disagree. The Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content.
EPA 10	QAPP; Section 9.2; Page 14; 1st paragraph	EPA: "This paragraph notes that analytical procedures for the field analysis of VOCs will be a DOE Prime Contractor-accepted procedure. This paragraph should be revised to include identification of the specific procedure to be used for field analysis of VOCs."	Disagree. The Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content.
EPA 11	QAPP; Section 12.2; Page 19; 1st paragraph	EPA: "This paragraph notes that QA surveillance will be performed in accordance with a DOE Prime Contractor-approved procedure. This paragraph should be revised to include identification of the specific procedure(s) to be used for QA surveillance, and a brief summary of the types of activities anticipated to be conducted during QA surveillances."	Disagree. The Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content.

COMMENT RESPONSE SUMMARY
for the
Site Investigation Work Plan for the C-746-S&T Landfill at the Paducah Gaseous Diffusion Plant, Paducah, Kentucky
(DOE/OR/07-2098&D1 issued September 2003)

Comment Number	Sect. Page/Para.	Reviewer and Comment	Response
EPA 12	QAPP; Section 16; Page 23; 4th bullet	EPA: "This bullet notes that, if necessary, Site Investigation documents (including the Work Plan, QAPP, and ES&HP) will be revised, reviewed, approved, and reissued. Additional text should be added to this bullet stating that all revised/reissued Site Investigation documents should be reviewed and approved by federal and state regulators prior to implementation."	Partially agree. Although DOE will maintain open communication with the federal and state regulators, the Site Investigation Work Plan, QAPP, DMIP, WMP, and ES&HP are secondary documents under the FFA, and formal approval by EPA and KDEP is not required.
EPA 13	QAPP; Section 17; Page 23; 1st paragraph	EPA: "This paragraph notes that project materials will be inspected according to a DOE PrimeContractor-approved procedure. This paragraph should be revised to include identification of the specific procedure to be used for inspection of project materials."	Disagree. The Department of Energy is planning a change in subcontractors at the PGDP. For this reason, the Site Investigation Work Plan and supporting documents were prepared with an appropriate level of technical content and limited flexibility, but they do not include company-specific materials (e.g., names of key personnel, procedure numbers, etc.). We believe that the work plans can be approved based on their technical content.
EPA 14	Data Mgmt. Implementation Plan	EPA: "No comments."	No reply required.
EPA 15	Waste Mgmt. Plan	EPA: "No comments."	No reply required.
EPA 16	ES&H Plan	EPA: "No comments."	No reply required.